Center for Independent Experts Peer Review Report

Nontarget Species Groups in Alaska

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Executive Summary

The Alaska Fishery Science Center (AFSC) has made impressive efforts to assess data-poor non-target species in accordance with the Tier system specifications. Given the limited data available, the assessment methods applied for setting total allowable catch are acceptable for most species complexes. The groundfish FMPs state that a reliable biomass estimate must be available for a species to be managed under Tier 5 considerations. In actuality, it is likely to be impossible to come up with accurate (precise with minimum bias) estimates of absolute biomass even for bottom-dwelling non-targeted species because the underlying data from bottom trawl surveys mostly are limited to soft-bottom habitats, and also may not cover the entire depth range and spatial range of the species distributions. The longline surveys provide data on relative abundance and biomass for grenadiers, but data from passive gears cannot be extrapolated to absolute biomass and abundance since the unit of effort cannot be related to a known area. For pelagic species, the bottom trawl survey clearly cannot be used to estimate abundance and biomass reliably. It is recommended to modify the requirements in the Fishery Management Plan (FMP) so that Tier 5 is based on relative abundance indices, or alternatively minimum absolute biomass estimates. It is also advised that adequate documentation of the survey catchability be provided when survey indices are scaled up to absolute biomass. The bottom trawl surveys in Bering Sea-Aleutian Islands (BSAI) and Gulf of Alaska (GOA) are generally well designed, and AFSC has impressive quality assurance to ensure standardized trawling operations and gear performance, thus securing high quality data from the bottom trawl surveys. Area-swept estimates of relative abundance and biomass based on the bottom trawl surveys are likely to be adequate for bottom-dwelling species such as skates, sculpins, and the giant grenadier, at least for the habitat and depth range covered by the sampling frame. However, given the bias issues related to incomplete habitat and depth coverage in the bottom trawl survey, I do not consider it realistic to estimate absolute biomass for skates, sculpins, and the giant grenadier with a reasonable accuracy. An expansion of the survey to deeper waters, and the use of alternative sampling gear, e.g., based on optical methods, would be required to also cover bottom-dwelling species in rocky habitat. This is likely to be prohibitively expensive relative to required survey monitoring for targeted and valuable species in Alaska.

The age-sampling scheme currently employed for non-targeted species will generally not be sufficient for alternative and more advanced age-based assessments, where biomass or abundance by age is estimated from the bottom trawl survey data. The reason is that accuracy in estimated age-distributions is likely to be low since the sampling scheme does not specify that age-sample be collected from a representative sample of trawl stations in each stratum, and since the number of stations sampled per stratum appears to be small. Also, the fairly high age reading errors for most non-target species would contribute to poor estimates of age-distributions. The provided documentation of age sampling only provide number of fish from which otoliths were collected, and, no information on the number of hauls (PSUs). Hence, it is not possible to assess the precision, and the effective sample size for estimating age-distributions. The current age sampling and quality of age-readings seems acceptable for determining maximum age used to estimate natural mortality approximately.

The bottom trawl is likely inadequate for sampling other non-target species such as squid, sharks and octopus, and therefore it is reasonable to assesses these species according to a Tier 6 level, based on data from commercial fisheries. The proposed method of using a consumptive based estimate of biomass of octopus (consumption of octopus by Pacific cod) is innovative, but faces several bias problems and is not recommended as a standard method for Tier 5 assessment. If budget allows, I recommend that a dedicated survey with habitat pot gear as developed by Conners et al. (2012), with some refinement, be used to track year-to-year variation in octopus biomass over time in different areas. Such surveys could be conducted at alternate years.

Data on catches used for Tier 6 assessment of non-targeted species are likely to be greatly improved following the redesign and expansion of the observer sampling program in 2013 when coverage of the fleet was improved, and probabilistic sampling of trips and vessels were introduced. Species identification in general, and of skates in particular, has been more reliable since the late 1990s, by use of field guides, improved training, and collections of voucher species, etc. The current species identification in the observer program is excellent, although the identification of some sculpins still are challenging.

1. Background

This CIE review focuses on assessment methods applied by Alaska Fisheries Science Center (AFSC) for setting biological reference points for non-targeted species complexes (i.e., those species that are incidentally-caught) in the Alaska fishery. The goal of non-target species management is to protect them from effects of targeted fishing directed at other species. Non-target species require monitoring to ensure that the populations are not negatively impacted by commercial fishing, but data regarding catch, abundance and life history traits of these species are typically sparse or uncertain. The AFSC is responsible for stock assessment for 10 non-target species complexes in the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI), as well as two species complexes which are currently not included in the fishery management plan (FMP). This review focuses on the non-target species formerly managed as "other species" complex, which is divided into five non-targeted species complexes: squid, skates, sharks, sculpins and octopus, and in addition grenadiers who are under consideration for inclusion in the FMPs. There are currently no catch limits in place for grenadiers. Beginning in 2011, the BSAI fisheries management plan was amended to provide separate management for sharks, skates, sculpins, and octopus and set separate catch limits for each species group.

Data needs for stock assessment criteria as used in Alaskan groundfish fisheries are based on a Tier 1-6 system, where Tier 1 has most information (analytical age-based assessment), and Tier 6 has least information (harvest information used for benchmark assessment; only catch data are available). Non-target species are generally data-poor and assessed as Tier 5 (Requires reliable point estimates of Biomass and natural mortality rate M) or Tier 6 (requires reliable catch history from 1978 through 1995, or another specified historic period) where the harvest recommendations do not change from year to year. The amount and quality of fishery-dependent and fishery-independent data available to conduct the assessment varies by complex. Some species, such as skates, sculpins, and giant grenadier, are assessed using data from existing fishery independent surveys; the key challenge for skates and sculpins has been to improve species identification of the catch. Other species such as squid, sharks and octopus lack reliable fishery-independent data and have imprecise fishery-dependent data. This review focus on assessment methods developed by scientists at the AFSC to assign annual catch limits and overfishing levels to these non-target species groups. Of special concern is that for some species (e.g. sharks and octopus) these annual catch limits could limit commercial harvest of target species because the incidental catches of non-target species are counted towards the annual total catch limits within the Bering Sea/Aleutian Islands and Gulf of Alaska ecosystems. It is therefore important that best available methods be used to derive biological reference points for non-targeted species. Current methods range from determining biological reference points from simple historical catch data, to estimation of natural mortality based on predation. Of concern is that some species defined as non-targeted in fact have some market value, and may therefore be targeted (e.g. skates, grenadier). Further, some of these non-target species are highly migratory (e.g. sharks and skates) and move between Alaska state, federal and international waters. These species may not be adequately covered in the fisheries-independent surveys, and lack of data on commercial catch of these species outside of the FMPs may cause bias in the assessments. It is challenging to obtain sufficient data to adequately recommend acceptable catch limits for non-targeted species. The data used in assessing the groundfish stocks in Alaskan waters derive from broad scale bottom trawl research surveys and observer data from commercial fisheries. However, the bottom trawl research surveys in Alaska samples some non-target species well and others poorly. A particular problem is that some species favor rocky habitat that is untrawlable, with and is distributed spatially in only a limited part of the total survey area covered by the bottom trawl surveys.

2. Description of the Individual Reviewer's Role in the Review Activities

A peer review meeting was held at the Alaska Fisheries Science Center (AFSC) in Seattle, Washington, on May 28-30, 2013. The meeting was chaired and facilitated by Sandra Lowe, AFSC, in a well organized and effective manner, and was conducted in a spirit of cooperation and teamwork. The Center for Independent Experts (CIE) review panel consisted of Patrick Cordue (New Zealand), Matthew Cieri (U.S.) and Jon Helge Vølstad (Norway). Presentations were made to the CIE review panel by AFSC staff, during which the CIE panel members asked questions.

Preparations in advance of the peer review meeting included a review of background material and reports provided by the NMFS Project Contact Dr. Liz Conner. The required background material for this review was provided to the CIE review panel via FTP on May 18, 2013 (Appendix 1).

A series of very informative power-point presentations were given during the review meeting:

- Structure of NPFMC and regulatory history of non-target species in Alaska. Jane DiCosimo, North Pacific Fishery Management Council

- Setting catch limits for non-target stocks in Alaska groundfish fisheries. Olav Ormseth, AFSC

- Fishery-dependent data collection for non-target species and observer program restructuring. Martin Loefflad, AFSC, FMA Division

- Catch accounting and catch estimation for non-target species. Jennifer Mondragon, NMFS Alaska Regional Office

- AFSC bottom trawl surveys and biomass estimates, Bering Sea, Gulf of Alaska, and Aleutian islands. Wayne Palsson and Robert Lauth, AFSC RACE Division

- Overview of AFSC longline survey. Cara Rodgveller, AFSC

- Averaging and smoothing methods for trawl biomass time series. Paul Spencer, AFSC

- Aging methods for selected non-target species in Alaska. Tom Helser, AFSC

I obtained additional information about the sampling protocol and catch estimation methods employed in the observer program through a phone meeting with Jennifer Callahan and Lisa Thompson on May 31. Jennifer Callahan also provided the 2013 observer program manual, and several AFSC Research Feature Reports:

- The Restructured North Pacific Groundfish and Halibut Observer Program, by Craig H. Faunce, FMA Division, AFSC;

- At-Sea Monitoring of Commercial North Pacific Groundfish Catches: A Range of Observer Sampling Challenges, AFSC Quarterly Report 5, by Jennifer Cahalan

- Redesigns Observer Sampling by Jennifer Cahalan and Jennifer Ferdinand.

3. Summary of Findings for each ToR in which the weaknesses and strengths are described

3.1 Evaluation of data used in the assessments, specifically trawl and longline survey, abundance estimates, survey indices and recommendations for processing data for use in assessments, and whether available age data should be used in the assessments.

Bottom trawl surveys are used to estimate abundance and biomass for several non-target species complexes in the Bering Sea/Aleutian Islands and Gulf of Alaska. Primary spatial strata are Eastern Bering Sea (EBS) Shelf, EBS slope, Aleutian Islands (AI), and Gulf of Alaska (GOA). Further stratification is based on Regulatory areas, depth, and habitat (GOA only). The EBS shelf survey has been conducted since 1975, and annually since 1979. The EBS shelf bottom survey is conducted with chartered commercial trawlers (10 different vessels have been used over the years); with trawl stations selected across the survey area according to a stratified systematic design with a fixed start. The spatial coverage of the survey was varying from 1975-1981, and then held near constant since 1982. Each tow is conducted according to NMFS bottom trawl protocols established by the National Oceanic and Atmospheric Administration (Stauffer 2004), using a standardized otter trawl (83-112 design) made in-house by AFSC, with wrapped chain footrope. Towing time is approximately 0.5 h in duration at a speed of 3 nm per hour. The trawl survey on the EBS slope, AI, and GOA follows a stratified random design, and uses bottom trawl with the poly Nor'Eastern design and footrope with 8'' rubber disks. The trawl survey has been conducted biennially since 2002 on the EBS slope (30 min tow at 2.5. NM per hour), triennially from 1980 to 2002 and biennially thereafter in the AI survey (changed from 30 min to 15 min tows at 3nm per hour in 1996), triennially from 1984 to 1999 and biennially thereafter in the GOA (changed from 30 min to 15 min tows at 3 mm per hour in 1997). Two vessels are used in AI, and three vessels are used in GOA.

Mean abundance and biomass per area-swept based on the trawl surveys are scaled up to the total survey area to estimate absolute abundance and biomass, under the strong assumption that survey catchability is unity. Area-swept is calculated as mean net width X distance fished (on to off bottom). Area-swept estimates of relative abundance and biomass based on the bottom trawl surveys are likely to be adequate for bottom-dwelling species such as skates, sculpins, and the giant grenadier for the spatial habitat covered by the survey, but the species identification for skates and sculpins are problematic for historic data. AFSC has impressive quality assurance to ensure standardized trawling operations and gear performance, thus securing high quality data from the bottom trawl surveys. The surveys are run with experienced cruise leaders and staff, and standardization of trawling is secured trough monitoring of vessel speed, measure of trawl geometry etc. Species identification in general and of skates in particular, has been more reliable since the late 1990s, by use of field guides, improved training, and collections of voucher species etc. The current species identification is excellent, although the identification of some sculpins still are challenging. The bottom trawl is likely inadequate for sampling other nontarget species such as squid, sharks and octopus.

Mean area-swept estimates of abundance and biomass are adjusted for survey catchability to estimate absolute abundance and biomass. This adjustment is likely to introduce a bias since total survey catchability cannot be reliably estimated. Survey catchability is determined by the efficiency of the trawl to capture animals in the swept area at each survey station, and the coverage of the area of occupancy for the species complex under investigation. Survey catchability would be unity if (1) the sampling frame includes the entire spatial distribution of the stocks, (2) the trawl is 100% efficient (i.e., retain all animals within a defined swept-area and in the whole water column), and (3) swept area estimates of stock abundance are based on representatively selected stations in the survey area. In actuality survey catchability will usually depart from unity since survey coverage usually is incomplete, and since the trawl efficiency is affected by avoidance, vertical and horizontal herding, and footrope and mesh escapement, which is species dependent. A further source of bias is that portions of the survey area is untrawlable, thus causing "non-response" type errors in survey estimates of abundance and biomass, especially in Eastern Bering Sea (EBS) slope, the Aleutian Islands (AI) and Gulf of Alaska (GOA). In the GOA, the sampling frame (area where trawls stations can be selected) covers 74% of the Shelf, 20% of gullies, and 6% of the slope. In the AI survey area, grid-cells are selected randomly within strata, and trawling locations within grid-cells are chosen by the captain after a search for trawlable bottom. The sampling frame for the trawl survey only includes 1000 out of ca. 20000 grid cells. Hence, a significant fraction of the potential area of occupancy for the non-target species is mostly untrawlable area. This can cause bias of unknown magnitude and direction if abundance in trawlable areas is very different from the abundance in untrawlable areas.

The AFSC longline survey in the AI and GOA slope and gullies began as cooperative survey on Japanese vessels (1978-1994), and was originally designed for sable fish. The survey has been conducted annually by the U.S. on the GOA slope (biennial in AI and Bering Sea) since 1996, and the gear is standardized in U.S. survey. The longline survey samples deeper water (on the slope) in GOA and AI in all habitats (including rocky relief habitat that is untrawlable), and therefore provide auxiliary information on the spatial distribution of grenadier and other non-target species. The survey is conducted by two contracted vessels annually in June-September in eastern AI, and is largely financed by the contracted vessels through a cost-recovery program where the vessel keeps catch of any species except salmon and halibut (not managed by NOAA). A semi-systematic design (stations are allocated every 30-60 km along the slope) is employed where long lines are set from shallow to deep and cover a wide range of depths down to 1000 m. One standardized long-line station consists of two long-line sets, each with 80 skates of length 100 m, and 45 hooks baited with squid. The stations (7200 hooks total) are at approximately fixed locations from year to year. Non-target species caught in the survey includes grenadiers, sharks (primarily spiny dogfish), skates (recorded by species since 2010), and sculpin (Yellow Irish lord). Catch of the grenadier species, dominated by giant grenadier, appear in the 400-600m depths, and densities remain strong throughout the surveyed depths down to 1000 meters suggesting that the longline survey only partially covers the depth range of this species complex. Relative population indices in numbers (RPN) or weight (RPW) are estimated as average CPUE (in numbers or weight) weighted by the size of area/strata. Western AI RPN is extrapolated from ratios of Eastern to Western AI from historic U.S.-Japan Cooperative Survey. Western AI were sampled from 1985-1994 by U.S. Japan Cooperative survey. Sources of recognized bias include poor coverage by area and depth (sampling effort is focused from 200-800 m on slope only), whale depredation (whales taking portions of the catch at many stations), and competition for hooks/hook saturation. Negative correlation is found between grenadier and sablefish CPUE in the longline survey, while no such correlation is found in the trawl survey.

Ongoing habitat mapping will over time allow comparison of cpue for rocky habitat with soft habitat for species complexes. It is important to assess if the ratio of abundance indices in trawlable and untrawlable areas is approximately constant over time. It is also recommended that time-series of longline survey data be compared to trawl survey data. However, the longline survey target locations with high catch of sable fish, and may not be representative for non-target species. The longline survey could possibly be evolved towards more representative sampling by employing sampling with partial replacement (Cochran 1977). An option could be to resample, say, 75% of the fixed sites, chosen at random, and adding 25% of sites at random from one year to the next. However, since the survey is paid for mostly by vessel owners through sale of sablefish catch, the random selection of stations may not be feasible within current funding.

3.2 Evaluation of analytical methods presently used in Tier 5 assessments. Evaluation may include: methods for estimating natural mortality (M), alternative biomass estimates (e.g. Kalman filter and survey biomass averaging, and consumption-based models.

Skates

BSAI Skates. Alaska skate, which is most abundant, is assessed using age-structured model (Tier 3), while "other skates" are assessed as Tier 5, using M = 0.1. The Tier 3 and Tier 5 recommendations are then combined to generate recommendations for the skate complex as a whole. Although an age-based (Tier 3) assessment is conducted for Alaska skate, this species is managed (i.e., quota is set) for the complex of skates because the species identification in the catch reporting is considered unreliable. Alaska Skate modeling (Tier 3) is problematic because the early years of survey indices were not used in the model. An alternative is to use the Tier 5 approach also for Alaska skate. In the future, reliable estimates of the catch of Alaska skate may be based on observed data, since the Observer program has be redesigned to minimize bias by improving coverage of the fleet, and by selecting vessels and trips representatively through random sampling.
GOA skates are all managed under Tier 5, with M=0.1. Separate catch specifications for big skate, longnose skate, and "other" (Bathyraja) skates. Big & longnose skate have area-specific ABC, and all have GOA-wide OFLs. Because of the spatial segregation of species it is suggested that Alaska skate be broken out for the ESB shelf (where it completely dominates), while a skate complex be used for ESB slope and AI. It is recommended to use length at age to model growth which is justified for the most recent data with the most reliable ageing. It is recommended Should evaluate variation in length at age across the 4 data sets. Note that survey indices in early 1980s with big increase in biomass are not used in the Stock synthesis model. NB: verify that bottom contact, trawl, and trawl procedures did not change during 1980s (technology creep).

Sculpins

The 48 species of sculpins are managed based on estimates of biomass from the bottom trawl surveys and estimates of M for 5 species. Most commercial bycatch occurs on middle and outer shelf areas used by bottom trawlers for Pacific cod and flatfish. Age-growth data are available for a limited number of species. The six most important sculpins are the yellow Irish lord, bigmouth sculpin, plain sculpin, warty sculpin, and threaded sculpin. The sculpins caught in commercial fisheries have been identified to genus by observers since 2004, and to species since 2008. Sculpins are bottom-dwellers and live in a broad range of habitats from rocky intertidal pools to muddy bottoms of the continental shelf and in rocky, upper slope areas. Most commercial bycatch occurs on middle and outer shelf areas used by bottom trawlers for Pacific cod and flatfish. It is likely that the trawl is highly efficient (i.e., retain most of the sculpins within a defined swept-area of bottom habitat) in trawlable mostly soft-bottom areas, and that effects of herding by the trawl doors may be small. However, several species of sculpins may also occupy rocky bottom habitats that are not covered in the bottom trawl survey. Hence, survey catchability is likely to be substantially less than unity, and the estimated absolute survey biomass is likely to be biased downwards. Sculpins in the BSAI are managed under Tier 5, where OFL = M x {average survey biomass} and ABC ≤ 0.75 * M * {average survey biomass}. Average biomass for the six most common species is calculated as the average of the last 3 surveys (2004, 2010, and 2012) in each area. Given that the age-span of most species is 16-20 years, it seems unreasonable to include 2004 with 2010 and 2012 in the average biomass estimate. I recommend that only 2010 and 2012 be used.

Estimates of M is based on age-based catch curve analysis for large sculpins (5 species that that represents approximately 90% of the estimated total biomass), and by Hoenig's (1983) method for threaded sculpins that represent small sculpins, based primarily on data from BSAI. Current method is to use a biomass-weighted average for M. GOA M estimates are based on BSAI life history data because very limited data is available from GOA. Given the availability of data, this approach is reasonable. However, given that AFSC staff has limited experience with the ageing of sculpins, it is recommended to send otoliths or digital images to other labs for verification as part of QA/QC procedures.

3.3 Evaluation, findings and recommendations on the analytic approach used for "data-poor" stocks that have no reliable estimate of biomass, specifically, Tier 6 species/stock complexes.

Sharks

It is appropriate to base the assessment of squid on Tier 6, and not Tier 5, since the AFSC bottom trawl surveys are directed at groundfish species. Also, the bottom trawl surveys do not necessarily cover the spatial range of many shark species as suggested by the large interannual variability in

CPUEs, and therefore do not provide reliable biomass estimates. It would be very costly to develop fisheries-independent surveys to monitor sharks, and this is not considered viable. Current method for assessing sharks is therefore acceptable because of data limitations. There are currently no directed commercial fisheries for shark species in federally or state managed waters of the BSAI and GOA, and most incidentally captured sharks are not retained. BSAI sharks became a separate complex in 2011, and include Spiny Dogfish, Pacific Sleeper Shark, Salmon Shark, and Other/Unidentified Sharks. The complex is managed as Tier 6, with OFL = Max Catch (1997-2007), and ABC = 0.75*OFL calculated for each species and summed for complex wide OFL/ABC. GOA sharks are a complex of Tier 5 (spiny dogfish) and Tier 6 (all other sharks) species. The OFL is based on the sum of the Tier 5 and Tier 6 (average historical catch between the years 1997 - 2007). Catch estimates by species from 1997-2007 based on observed data are, however, likely to be biased because of issues with fleet coverage. Most of GOA fishery has partial and zero coverage by observers, and observed trips may not provide reliable data on sharks by species because of identification problems and since most sharks are not retained. Shark catches in unobserved fisheries (halibut and salmon fisheries) are also poorly documented. There also could be significant bycatch of shark in gill net and seine fisheries, which are undocumented in the historic observed data. The quality of species ID has been problematic for some shark species historically, but has improved significantly over time. Species ID of sharks by observers is considered to be acceptable after 2005. The reliability in catch estimates of sharks by species is likely to improve significantly from 2013 due to the improved design of the observer program. In addition to the 100% coverage for vessels in a catch share programs and approximately 100% coverage of all catcher processors, random trips selection is implemented for trawlers over 57.5 feet (about 25000 trips every year will be sampled at 15% rate), and for vessels between 40 ft – 57.5 ft a group of vessels will be selected randomly every 2 months (N=520 vessels; ~ 50 vessels per 2 month sampled with replacement). Vessels less than 40 feet will not be sampled (about 1200 vessels). Small vessels operating in State waters have diverse landings, and are poorly covered by observer sampling. Also, there is no logbook requirements for vessels less than 60 ft. Logbook reports will likely not be a viable source of data for non-target species in Alaska because of species id issues. A possible tool for monitoring the smaller vessel fleet in the future is to develop electronic monitoring.

Squid

It is appropriate to base the assessment of squid on Tier 6 since the AFSC bottom trawl surveys are directed at groundfish species, and therefore do not provide reliable biomass estimates for the generally pelagic squids. However, mean catch from 1977 to 1995 is likely to be significantly higher than current catch levels, and it is uncertain if catches at this level would be sustainable. Main concern with squid by-catch is that squid is prey to other species (sperm whales, salmon, etc. which target different sizes). An option may be to use ecosystem models to assess what maximum catch should be. I recommend not using historic catch data to set ABC. Catch records for squids between 1977 and 1995 can be broken into “foreign” (1977-1987; when foreign vessels dominated the Alaska fleet), “joint venture” (1981-1989; shared fishing activities between domestic and foreign partners), and "domestic" (from 1987-present). Since 1990, only domestic vessels have operated in Alaskan waters. The foreign catches were much larger than present-day catches and likely present a mix of directed and incidental catches, and it is not documented that these catch levels were sustainable. Current catches are well under the total allowable catch limits but could increase because markets for squids exist and fisheries might develop rapidly. Following the new design of the observer program implemented in 2013, reliable estimates of squid catch, with quantifiable precision, may be obtained. An alternative to the Tier 6 assessment in the future is to monitor catch trends for species in the squid complex based on observer data. If cpue in pelagic commercial fisheries do not significant decline over time this may be adequate indication of sustainable stock levels.

Octopus

All octopus species are grouped into one species complex for the BSAI. Total allowable catch limits (TACs) for octopus in BSAI for 2011 were set using Tier 6 methods based on the maximum historical incidental catch rate. For 2012, a new methodology based on consumption of octopus by Pacific cod was introduced; this method is also proposed for 2013 and 2014. There are three major problems in conducting a quantitative stock assessment for Alaskan octopus. Alaskan waters are inhabited by seven or more species of octopuses, and separation of octopus by species is difficult even for trained biologists. Trawl survey indices of abundance and biomass, and the growth and life history patterns of octopus, like squid, are unsuitable for age-structured assessment model used for groundfish management. Catch limits for octopus in GOA for 2011 and 2012 were set based on using the average of the last 3 surveys as a minimum biomass estimate. Existing bottom trawl surveys for collection of fishery-independent data are ill-suited to octopus. The new methodology based on consumption of octopus by Pacific cod proposed for 2013 and 2014 is innovative, but faces several methodological problems. First of all, the consumption rate is based on a "snap-shot" survey during summer, and cannot reliably be extrapolated to the whole year because of changes in spatial overlaps between octopus and Pacific cod, and likely changes in consumption rates over the year. Also, the total consumption of octopus by Pacific cod also would require reliable estimates of the absolute abundance and biomass of Pacific cod in areas where the two stocks overlap. The "best" estimate of Pacific cod biomass should be based on the official stock assessment, but this estimate is not spatially specific. I recommend that the consumptive based estimate of octopus biomass not be used for setting ABC.

I strongly agree that a dedicated survey with habitat pot gear as developed by Conners et al. (2012), with some refinement, is the most promising method to estimate relative indices of abundance and biomass, and for tracking year-to-year variation in octopus biomass over time in different areas. If budgets allow, I recommend that this method be further developed. Based on current data, I do not see any viable method to track biomass of octopus over time.

3.4 Review of the grenadier assessment and the reliability of the estimation of biomass.

Giant grenadier is the most abundant grenadier species and is used as a proxy for all grenadier species in assessment. The estimation of M based on the Hoenig (1983) method is reasonable given the available data. Cpue from the bottom trawl surveys may track the trends in abundance and biomass over time but there are multiple sources of bias related to spatial, depth and habitat coverage that cannot easily be adjusted for. Given the bias issues related to incomplete habitat and depth coverage in the bottom trawl survey described in section 3.1 I do not consider it realistic to estimate absolute biomass for grenadiers with a reasonable accuracy. The cpue analysis based on trawl survey data mainly applies soft habitats and to depths down to 700 m, and it is assumed that the fraction of total biomass that is accounted for by the portion of the stock below 700 m is constant (for exploitable biomass). If budget allows, it is recommended to include embedded experiments in the trawl surveys to test this assumption. At selected locations along the slope, trawl stations could be taken along transects that go deeper than 100 m. Data from such experimental tows could be used to track the ratio of {cpue depth <700}/{cpue depth [700-1000+)}.

The trawl survey in AI is limited to 500 m depth, and max depth in GOA has varied between 500 m, 700 m, and 1000m over the years, while EBS survey has covered down to 1200 m. Majority of grenadier biomass is likely to be at depths greater than 500 m, as indicated by highest abundance and largest fish in the deepest depth strata. A further source of bias is that data from surveys conducted between1984-1995 are used to estimate the ratios of abundance of east to west AI. Due to these extrapolations, AI abundance index is much greater than in other areas. This extrapolation is based on the strong assumption that the abundance in east AI relative to west AI is constant over time. Also, movement in and out from deeper waters not covered by the bottom trawl survey is suggested by big yearly variation in the survey index for this long lived species. Negative correlation between grenadier and sablefish CPUE, which is not found in the trawl survey, suggest competition for hooks, and a bias in cpue as measure of biomass and abundance. The low cpue in longline surveys for males relative to females, which is not found in the trawl survey, also suggest a bias. This could be further investigated by the use of alternate hook size for sub-set of stations, or for a random sub-set of hooks at each station. To track relative abundance and biomass over time the use of the Kalman filter or random effects models yields similar results, and both methods are reasonable and also allows for the estimation of precision in relative abundance and biomass indices.

3.5 Review age information that is available for a number of the Alaska “non-target” species, including spiny dogfish, giant grenadier, yellow Irish lord, great sculpin, and plain sculpin. Age of maturity information is also available for giant grenadier. Although the ages have not been validated, use of these age data in the assessment process could result in moving these species to a higher assessment tier. Provide recommendations on how to proceed with the age data.

Age-sampling and estimation of numbers at age based on data from the trawl surveys

According to the 2006 Eastern Bering Sea survey data report and information provided during discussions at the review meeting, the protocol for age sampling specifies the number of otoliths to be collected per sex/length interval in each area/stratum for 20 fish species. The protocol specifies that three otolith pairs per sex/centimeter interval in an area be collected for great sculpin, plain sculpin, warty sculpin, and yellow Irish lord (YIL). This sampling protocol does not specify how age-sampling should be allocated across stations in each area/stratum. If age samples are not collected from a representative sample of trawl stations within each stratum, the estimates of age-composition of a stock may be biased. The reason is that age-at-length typically varies spatially. An additional disadvantage of the current protocol is that age-samples are aggregated by length bins within strata. This precludes the estimation of sampling errors in age-distributions though bootstrapping of primary sampling units (stations), and therefore also precludes the estimation of effective sample sizes. If fishery age composition by year is modeled as a multinomial distribution, a measure of effective sample size for each year will be required to approximately adjust the precision for effects of clustering. In my opinion, the current age-sampling protocol for non-target species will not support the use of age-based assessment models. The age-data may, on the other hand, provide reasonable information on maximum age.

In the following I present an alternative age-sampling and method for estimating numbers-at-age from trawl samples.

Sampling for age in trawl surveys is typically conducted in multiple stages, where

(1) stations (standardized area-swept) are the primary sampling units,

(2) a subsample of fish for selected species is measured for length, and

(3) age samples are collected from a sub-sample of fish measured for length.

It is recommended that a sampling protocol be followed where a random sample of fish from each PSU (or a random sample of PSUs) is measured for length, and that a small number of otoliths be collected from suitable length bins for each PSU. At Institute of Marine Research in Norway, a random sample of one otolith is collected from each 5 cm length bin for commercially important species from all stations. The precision in estimated age-distributions is only marginally, if at all, improved by collecting more than one otolith per length bin (also see ICES 2013). For non-target species in Alaska, age-sampling could be conducted at a random sub-set of stations, and the bin-size might be increased to 5 cm to reduce accommodate the sampling of more stations and to reduce the workload, if necessary.

Alternative estimators for abundance indices at age based on sampling theory.

An estimator of fish density at age (numbers at age for a standardized effective area-swept) at station i in stratum h is:

$$\rho_{h,i}(a) = \rho_{h,i} p_{h,i}(a) = \sum_{l} p_{h,i}(a \mid l) \rho_{h,i}(l) \tag{0.1}$$

where for each station

- $p_{h,i}(a)$ is the estimated proportion at age,
- $\rho_{h,i}$ is the overall fish density across age and length,
- $p_{h,i}(a \mid l)$ is the proportions of age within each length group,
- $\rho_{h,i}(l)$ is the density for a length group l .

Note that $p_{h,i}(a \mid l)$ is an age-length key (ALK) for station i in stratum h. This approach is consistent with Kimura (1977) and Hoenig (2002).

An estimator for the average density $\rho_{h,l}$ of fish in length group l within stratum h is:

$$\hat{\rho}_{h,l} = \frac{1}{n_h} \sum_{i}^{n_h} \hat{\rho}_{h,i,l} \tag{0.2}$$

and an estimator for average density of fish at age a within stratum h is

$$\hat{\rho}_h(a) = \frac{1}{n_h} \hat{\rho}_{hi}(a) \tag{0.3}$$

where n_h is the number of stations in stratum h. The variance of the average density $\rho_{h,l}$ of fish in length group l or age group a within stratum h can be estimated by the standard estimator (Cochran 1977) or by bootstrapping.

An estimator of the mean density at age for the entire surveyed area is the standard stratified mean density:

$$\hat{\rho}_y(a) = \sum_h w_h \hat{\rho}_{h,y}(a) \tag{0.4}$$

where the weights are the proportion of each stratum of the total area covered

$$w_h = \frac{A_h}{\sum_h A_h} \tag{0.5}$$

and an estimator of the variance of (0.4) is

$$Var\left(\hat{\rho}_y(a)\right) = \sum_h w_h^2 Var\left(\hat{\rho}_{h,y}(a)\right) \tag{0.6}$$

(see e.g. Cochran 1977).

The estimate of total abundance for the entire area is then obtained by expanding the mean density to the total survey area

$$\hat{N}_y(a) = A\hat{\rho}_y(a) \tag{0.7}$$

with variance

$$Var\left(\hat{N}_y(a)\right) = A^2 Var\left(\hat{\rho}_y(a)\right) \tag{0.8}$$

This approach for estimating indices of abundance by age has been developed and implemented in R by Aanes and Vølstad (MS in prep.). Uncertainty in estimated age distributions can be assessed though bootstrapping. The variance of the abundance indices by age within and across strata and effective sample sizes can be estimated under the assumption of simple random sampling of stations for strata where systematic sampling is used. Many studies have concluded that a systematic design with regularly spaced samples can be optimal for a variety of reasonable spatial correlation functions of the sampled populations (see Steven and Olsen 2004, and many references therein). The systematic design will outperform all alternative schemes for certain underlying spatial autocorrelation structure in abundance (see, e.g., Dunn and Harrison 1993, and references therein). Bartolucci and Montanari (2006) present several unbiased estimators of the variance of the systematic sample mean under mild conditions. Dunn and Harrison (1993) show that a post-stratification of the systematic sample (e.g., pooling of 2 grid-cells to yield post strata with two samples each), and the use of a variance estimator that treats the sample as a stratified random sample, may reduce the bias in the variance estimates as compared to treating the survey as a stratified random, based on original strata boundaries.

Reliability of age-readings

Comparisons of readers suggest mostly a random, and not systematic, error in age-readings. I therefore find it reasonable to use simple proxy methods for estimating M, for example based on maximum age (e.g., Hoeing's method). Validation of age readings of sculpins by comparing two readers suggests that agreement within +/- 1 year is approximately 80% for all species but plain sculpin (53% agreement). Comparisons of two readers for Giant grenadier, and several skate species also suggest random errors in age readings. It is recommended that AFSC develop QA/QC procedures for age readings that include sending otoliths to other laboratories with experienced readers for independent verification.

Presentations at the review meeting suggest appreciable uncertainty in age-readings. One possible way of accounting for ageing errors in estimates of age-distributions is to follow Hirst et al. (2005) and create a matrix of ageing errors. One possible way to estimate p(observed age | true age) is to regard all true ages as parameters to be estimated. A simple approximation would be to take the true age as the mode of multiple age readings.

Matrix of aging errors (Hirst et al. 2005)

$$\begin{array}{ccc}
 & & \text{True Age} \\
 & & \begin{array}{ccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{array} \\
\text{Observed Age} & \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \end{array} & \begin{pmatrix}
0.9 & 0.1 & 0 & 0 & 0 & 0 & 0 \\
0.1 & 0.8 & 0.1 & 0 & 0 & 0 & 0 \\
0 & 0.1 & 0.8 & 0.1 & 0 & 0 & 0 \\
0 & 0 & 0.1 & 0.8 & 0.1 & 0 & 0 \\
0 & 0 & 0 & 0.1 & 0.8 & 0.1 & 0 \\
0 & 0 & 0 & 0 & 0.1 & 0.8 & 0.1 \\
0 & 0 & 0 & 0 & 0 & 0.1 & 0.9
\end{pmatrix}
\end{array}$$

3.6 Recommendations for further improvements

AFSC is spending significant efforts on the assessment of non-targeted species, and substantial improvements in assessment methods for Tier 5 would require the development of reliable sampling methods for rocky habitats, improved spatial and depth coverage for the surveys, and documented estimates of survey catchability. Such changes would be likely be very costly, and may not be justified relative to other monitoring needs. The ongoing habitat mapping, however, suggests that a certain effort be made to evaluate if density of fish by species in rocky habitats differs significantly from densities in soft habitats. The use of optical methods would be an option here. The use of embedded experiments in the bottom trawl survey could also include the sampling at extended depths, for example along transects that extends deeper than standard stations at the edge of the depth range. The use of longline surveys has the advantage that soft as well as rocky habitats can be included in the sampling frame. This survey series may be used to assess habitat differences in biomass and abundance for some species such as grenadiers. It is recommended to include embedded experiments where alternate hook sizes, and possible alternate baits, be tested. Also, extra longline sets at random location could be incorporated to augment the standard survey where sites with high abundance of pacific cod are favored. This could help reduce bias in cpue from the longline surveys. For species assessed under Tier 6 it is recommended to take advantage of the probabilistic sampling implemented in the observer program from 2013 to estimate the precision of catch estimates. Also, it may be useful to use cpue from commercial fisheries, based on the observer data, as a proxy to follow trends in on-target species over time.

3.7 The reviewer shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

The non-targeted species review process was generally well organized, but this review was particularly challenging because of the many species and assessment methods covered in a limited time. The three reviewers each had their primary area of expertise in different fields, and in my opinion the review would be more effective if a common review report was developed instead of three separate reports. This would allow each reviewer to go more in depth in certain areas. A section of a common report could be dedicated to areas where the reviewers disagreed, or had different recommendations.

4. Conclusions and Recommendations in accordance with the ToRs

In general, AFSC is spending impressive efforts at assessing non-target species. However, the Tier 5 requirement of reliable absolute biomass estimates in the FMPs is very ambitious in my opinion, and can only be achieved, if at all, at great cost. Some modification of the Tier 5 requirement seems warranted. Accurate biomass estimates would require (1) sampling frames that covers the entire area of occupancy for each species complex, (2) sampling gears that can be used effectively in all habitats, and (3) accurate estimates of survey catchability for each species complex. Some suggestions for improvements that could be achieved with more limited efforts are provided under each topic above. Alternative methods for tracking the status and trends of non-targeted species could be based on survey estimates of relative abundance, along with documentation of potential sources of bias. For Tier 6 species the redesigned observer program should greatly improve estimates of the catch of non-targeted species through probabilistic sampling and improved coverage of the fleet. If additional catch information from state surveys also is included, trends in catch and cpue may be sufficient for a crude monitoring. The development of fisheries-independent surveys for Tier 6 species would likely be prohibitively expensive. However, if budgets allow, a dedicated survey with habitat pot gear as developed by Conners et al. (2012), with some refinement, is likely to be the most effective method to track year-to-year variation in octopus biomass over time in different areas. Such surveys could be conducted at alternate years to reduce cost.

It is recommended that the current age-sampling scheme for non-targeted species be modified so that otoliths be collected from all trawl stations, or a representative subset of stations, and that the size-bin for length-stratified subsampling be increased, if necessary, to restrict the total number of otoliths sampled. This modification could increase precision for the same number of otoliths collected by increasing the number of primary sampling units (PSUs). Also, this change would improve the representativeness of the length-at-age samples, and thence likely improve estimates of growth.

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Appendix 2: A copy of the CIE Statement of Work

External Independent Peer Review by the Center for Independent Experts
Review of Assessment Methods for Non-Target Species in the North Pacific

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. The CIE reviewer is selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance with the predetermined Terms of Reference (ToRs) of the peer review. The CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: The Alaska Fisheries Science Center (AFSC) is responsible for stock assessment for 10 stocks/complexes in the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) which are considered "non-target", as well as two species complexes which are currently not included in the fishery management plan (FMP). The requirement in the re-authorized Magnuson-Stevens Act (2007) to set annual catch limits (ACLs) based on science recommendations implies some kind of basic assessment is required for all species in the FMPs. In response to these new requirements, the North Pacific Fishery Management Council divided the non-target species formerly managed as "other species" complex into five species complexes: squid, skates, sharks, sculpins and octopus. Assessments were developed for each species group. Grenadiers were not in the other species complex and are not currently in either of the FMPs; however, an unofficial stock assessment has been done since 2006 and grenadiers are under consideration for inclusion in the FMPs. The amount and quality of fishery dependent and fishery independent data available to conduct the assessment varies by complex. Some species such as skates, sculpins, and giant grenadier are adequately assessed by existing fishery independent surveys; the key challenge for skates and sculpins has been to improve species identification of the catch. Other species such as squid, sharks and octopus lack reliable fishery independent data and have imprecise fishery dependent data. Further, bycatch in unobserved fisheries may be significant, such as in Alaska state-managed salmon fisheries. Scientists at the AFSC have developed techniques to assign annual catch limits and overfishing levels to these non-target species groups. In some cases (e.g. sharks) these annual catch limits could limit commercial harvest of target species. Because of this potential interaction with commercially targeted species and the key role of these non-target species within the Bering Sea/Aleutian Islands and Gulf of Alaska ecosystems, the methodology used to derive biological reference points for non-target species has been the focus of considerable attention by the public and scientific community. A variety of assessment techniques are used, from simple historical catch to estimation of natural mortality based on predation.

While these species/complexes are considered as non-targets, there are commercial concerns to be considered. Some species/complexes have either been targeted or have some market value (e.g. skates, grenadier), promoting retention of the catch. In the case of grenadier, because they are not included in the FMP, there are no catch limits in place. Further, some of these non-target species are highly migratory (e.g. sharks and skates) and move between Alaska state, federal and international waters. Catch of these species outside of the FMPs may be relevant to the assessments.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewer: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. The CIE reviewers shall have working knowledge and recent experience in the application of fishery stock assessment methods, especially for data-limited stocks. One reviewer should have expertise in length or –age based stock assessment modeling. Two reviewers should have expertise in population dynamics, survey design and abundance estimation. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Seattle, Washington during 28-31 May 2013.

Statement of Tasks: The CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, and contact details) to the COR, who forwards this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewer with the background documents, report, foreign national security clearance, and information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Foreign National Security Clearance: When the CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for each CIE reviewer if a non-US citizens. For this reason, each CIE reviewer shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at

least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/sponsor.html).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to each CIE reviewer the necessary background information and report for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. Each CIE reviewer is responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. Each CIE reviewer shall read all documents in preparation for the peer review.

AFSC will provide copies of the statement of work, stock assessment documents, prior CIE review documents, and other background materials to include both primary and grey literature.

This list of pre-review documents may be updated up to two weeks before the peer review. Any delays in submission of pre-review documents for the CIE peer review will result in delays with the CIE peer review process, including a SoW modification to the schedule of milestones and deliverables.

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs cannot be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewer as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Report: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Specific Tasks for CIE Reviewer: The following chronological list of tasks shall be completed by the CIE reviewers in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and report provided by the NMFS Project Contact in advance of the peer review.

2) Participate during the panel review meeting at the AFSC in Seattle, WA during 28-31 May 2013 as called for in the SoW.

3) During the review meeting in Seattle, WA during 28-31 May 2013 as specified herein, each CIE reviewer shall conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than 13 July 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to David Die ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

3 May 2013	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
14 May 2013	NMFS Project Contact sends the CIE Reviewer the pre-review documents
28-31 May 2013	The reviewer participates and conducts an independent peer review during the panel review meeting
14 June 2013	The CIE reviewer submits draft CIE independent peer review report to the CIE Lead Coordinator and CIE Regional Coordinator
28 June 2013	The CIE submits CIE independent peer review report to the COR
5 July 2013	The COR distributes the final CIE report to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on substitutions. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review report by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, this report shall be sent to the COR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review report) to the COR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall be completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) each CIE report shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COR. The COR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Key Personnel:

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Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

a. The reviewer should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

b. The reviewer should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

c. The reviewer should elaborate on any points raised in the Summary Report that they feel might require further clarification.

d. The reviewer shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following

appendices: Appendix 1: Bibliography of materials

provided for review
Appendix 2: A copy of the CIE Statement of Work
Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

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Annex 2: Terms of Reference for the Peer Review of Assessment Methods for Data-Moderate Stocks

The reviewers will participate in the Panel review meeting to conduct independent peer reviews of the non-target species assessment methods to apply to groundfish stocks managed by the North Pacific Fishery Management Council. The review solely concerns technical aspects of the methods, and addresses the following ToR:

1. Evaluation of data used in the assessments, specifically trawl and longline survey, abundance estimates, survey indices and recommendations for processing data for use in assessments, and whether available age data should be used in the assessments.
2. Evaluation of analytical methods presently used in Tier 5 assessments. Evaluation may include: methods for estimating natural mortality (M), alternative biomass estimates (e.g. Kalman filter and survey biomass averaging, and consumption-based models.
3. Evaluation, findings and recommendations on the analytic approach used for "data-poor" stocks that have no reliable estimate of biomass, specifically, Tier 6 species/stock complexes.
4. Review of the grenadier assessment and the reliability of the estimation of biomass.
5. Review age information that is available for a number of the Alaska "non-target" species, including spiny dogfish, giant grenadier, yellow Irish lord, great sculpin, and plain sculpin. Age of maturity information is also available for giant grenadier. Although the ages have not been validated, use of these age data in the assessment process could result in moving these species to a higher assessment tier. Provide recommendations on how to proceed with the age data.
6. Recommendations for further improvements

Annex 3: Tentative Agenda

2013 CIE Review of Non-target Species Groups in Alaska

Alaska Fisheries Science Center, Building 4 room 2143
7600 Sand Point Way NE, Seattle, WA 98115
Phone: (206) 526-4000

Contact for security and check-in: Julie Pearce
Contacts for additional documents: Elizabeth Conners

Tuesday, May 28

9:00 Introductions, agenda, and meeting format. *Sandra Lowe, AFSC, meeting chair*
9:15 Structure of NPFMC and regulatory history of non-target species in Alaska. *Jane DiCosimo, North Pacific Fishery Management Council*
9:40 Overview of models for setting catch limits with limited data. *Olav Ormseth, AFSC*
10:00 Discussion
10:30 Break
10:45 Fishery-dependent data collection for non-target species and observer program restructuring. *Martin Loefflad, AFSC, FMA Division*
11:15 Catch accounting and catch estimation for non-target species. TBD*, NMFS AK Regional Office*
11:30 Discussion
12:00 LUNCH
1:00 AFSC bottom trawl surveys and biomass estimates, Bering Sea, Gulf of Alaska, and Aleutian islands. *Wayne Palsson and Robert Lauth, AFSC RACE Division*
1:45 Discussion
2:15 Overview of AFSC longline survey. *Cara Rodgveller, AFSC*
2:30 Discussion
2:45 Break
3:00 Averaging and smoothing methods for trawl biomass time series. *Paul Spencer, AFSC*
3:20 Discussion
3:40 Aging methods for selected non-target species in Alaska. *Tom Helser, AFSC*
4:10 Discussion
5:00 Conclude

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CIE Review of Non-target Species Groups in Alaska

Wednesday, May 29

9:00 Stock assessment of sculpins in the BSAI and GOA. *Ingrid Spies, AFSC*
9:30 Mortality rate estimation for sculpins in the BSAI and GOA – *Todd TenBrink, AFSC*
10:00 Discussion
10:30 Break
10:45 Stock assessment of skates in the BSAI and GOA*.* *Olav Ormseth, AFSC*
11:30 Discussion
12:00 LUNCH
1:00 Stock assessment model for Alaskan skate. *Olav Ormseth, AFSC*
1:30 Discussion
2:00 Stock assessment of sharks in the BSAI and GOA. *Cindy Tribuzio, AFSC*
3:00 Discussion
4:00 Analysis requests from panel, panel deliberations
5:00 Conclude

Thursday, May 30
9:00 Stock assessment of grenadiers in the BSAI and GOA. *Cara Rodgveller, AFSC*
9:45 Discussion
10:30 Break
10:45 Stock assessment of squids in the BSAI and GOA. *Olav Ormseth, AFSC*
11:15 Discussion
12:00 LUNCH
1:00 Stock assessment of octopus in the BSAI and GOA. *Elizabeth Conners, AFSC*
1:45 Discussion
2:30 Estimating octopus mortality from predator consumption models. *Kerim Aydin, AFSC*
3:00 Break
3:15 Discussion
4:00 Analysis requests from panel, panel deliberations
5:00 Conclude

Friday, May 31
9:00 Panel deliberations, panel and reviewer reports.
12:00 LUNCH
1:00 Panel deliberations, panel and reviewer reports
4:00 Conclude